

rapid release of the drug whereas other modalities can have sustained drug delivery. The speakers in this forum will describe the pros and cons of each of the drug delivery systems that are designed to improve bioavailability of cancer chemotherapy to sites of neoplasia. X-ray guided drug delivery exploits the stress response within cancer that occurs during radiotherapy. Low doses of radiation induce DNA strand breaks and oxidative stress within cancer. Stress proteins such as GRP78, TIP1 and Calreticulin are induced and transported to the surface of cancer cells following irradiation. Antibodies and peptide ligands that are specific to these radiation inducible neoantigens are used to coat the surface of nanoparticles and liposomes for guided drug delivery. This strategy of x-ray guided drug delivery is analogous to military use of lasers to tag targets for smart bombs. X-rays are tissue penetrating and therefore tag deep seated cancers for the binding of antibodies and peptide ligands. The discovery platform for this technology identifies inducible antigens that are specific to cancer and not induced in normal tissues. Antigens that are induced in normal tissues are discarded while cancer specific antigens are developed. These targeting moieties are conjugated to drug delivery systems. In contrast, hyperthermia is used to heat a tumor. As liposomes pass through the tumors, the lipids melt and release the drug in that volume. This strategy of thermal regulation of drug delivery has entered Phase III clinical trials in breast cancer to deliver Doxorubicin. The use of magnetic nanoparticles for drug delivery is still in the preclinical stage. Paramagnetic nanoparticles have been targeted to tumors for both drug delivery and to heat tumors. Oscillating magnetic fields cause these nanoparticles to vibrate and heat the tumor to induce hyperthermia. These three forms of image guided drug delivery will be compared and contrasted during the debate of the practicality of bringing these new strategies of drug delivery into clinical trials.

SP-0539**Using heat to control the release of drugs in cancer**

L. Lindner

University of Munich, Germany

Abstract not received

SYMPOSIUM: CLINICAL EXPERIENCE AND CURRENT EVIDENCE (INCL. PLANNING STUDIES) FOR PROTON THERAPY

SP-0540**The level of evidence for proton therapy**M. Pijls-Johannesma*MAASTRO Clinic, Maastricht, The Netherlands*

Abstract not received

SP-0541**Evidence- vs. re-imburement vs. patient-demand based proton therapy**E. Hug*ProCure Headquarters, New York, USA*

Abstract not received

SP-0542**Clinical experience and evidence for proton therapy of paediatric cancer patients**B. Timmermann¹¹*Westgerman Proton Therapy Center Essen (WPE) gGmbH, University Hospital, Essen, Germany*

Proton beam therapy seems to offer significant advantages over conventional techniques especially for the pediatric cohort and the number of children being treated with proton therapy for solid tumors is increasing rapidly throughout the world. There have been multiple dosimetric studies clearly demonstrating that protons decrease the irradiated volume and therefore the dose to the developing normal tissues compared with photon techniques while showing excellent outcome in the pediatric population. As in paediatric malignancies survival rates have increased considerably, from 0-20% until the 50ies up to about 80% today, quality of life (QoL) and late sequelae have become a major concern in pediatric cancer survivors. Therefore, proton therapy was understood as a tool potentially reducing the risk for secondary malignancy induction as well as for late effects. As children are particularly sensitive to radiation injury, they seem to be

the cohort taking the greatest potential benefit from sparing dose to normal tissue. Today, local treatment with proton beam in CNS tumors or sarcomas is a common choice to be offered to the pediatric cohort in Europe and in US whenever available.

It is suggested from early reports, that secondary cancer incidence may be reduced by 50% when using proton therapy. Additional early data was published on neurocognitive functioning and quality of life, both suggesting favourable outcome after proton beam therapy. Still, prospective data are limited, cohorts are small and observation times not sufficient, especially when looking at very young children being treated with proton beam therapy.

In conclusion, proton beam therapy is a promising tool to explore particularly in the pediatric cohort to reduce the risk for late effects and secondary malignancies; however, due to limited availability up to now, clinical experience of proton therapy in childhood cancer is still limited. Therefore, all pediatric programs should be accompanied by prospective evaluations of late effects and QoL to gather more information on optimal use of proton therapy. Due to small number of patients and ethical considerations, randomized data will be hardly available even on the long term in children. Still, more clinical data will be emerging to quantify the clinical benefit of proton beam therapy with regard to a decrease in late effects while maintaining excellent cancer control rates.

PROFFERED PAPERS: PHYSICS 11: OUTCOME MODELLING

OC-0543**Patient-specific in vitro measurements of SF₂ and T_{pot} - how well do they predict the tumour control probability?**M. Hedman¹, T. Björk-Eriksson², O. Brodin¹, I. Toma-Dasu³¹*Karolinska Institutet, Department of Oncology and Pathology, Stockholm, Sweden*²*Skåne University Hospital and Lund University, Department of Oncology, Lund, Sweden*³*Karolinska Institutet, Medical Radiation Physics, Stockholm, Sweden*

Purpose/Objective: The aim of this study is to investigate the predictive value of the modelled tumour control probability (TCP) based on BED calculations using individual measurements of in vitro radiosensitivity (SF₂) and potential doubling time (T_{pot}) for head and neck (H&N) cancer patients versus literature-based average radiobiological parameters.

Materials and Methods: Tumour radiosensitivity, measured *in vitro* on primary biopsies and expressed as surviving fraction of cells following an acute exposure of 2 Gy (SF₂), T_{pot} and tumour size were determined for 46 H&N cancer patients. All patients were treated with external beam radiotherapy and 28 patients also received brachytherapy. For each patient TCP was calculated using a Poisson-LQ model based either on the patient-specific radiobiological parameters or literature-based average radiobiological parameters ($\alpha=0.3 \text{ Gy}^{-1}$ and T_{pot}=3 days). The predicted TCP values for the two sets of parameters were compared with the actual outcome for the patients in terms of local control.

Results: The average radiobiological parameters lead to a large underestimation of TCP as the predicted TCP was below 10% for the majority of the patients that actually presented local control. When tumour specific parameters were used, the majority of the patients with local control had a predicted TCP larger than 90%. A Receiver Operating Characteristic (ROC) curve analysis was also performed for assessing the predictive values of the two methods for calculating the TCP. The corresponding ROC curves are shown in Figure 1.